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CEREAL BREAKFAST FOODS.

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Three years ago a bulletin was issued from this Station containing the analyses of about 40 cereal breakfast foods. The demand for the bulletin proved unexpectedly large and persistent and the edition was soon exhausted. In view of the growing importance of this class of foods it has seemed advisable to issue another bulletin upon the same subject, containing the analyses of those preparations which are found upon the market to-day.

THE CEREAL GRAINS.

Among the vegetable foods best adapted to the wants of man, the cereal grains occupy by far the most prominent place. The methods by which these grains are prepared for our use are so various and the manufactured products so multitudinous that it is difficult to fix the relative food value of the grains themselves. Thus it would be manifestly unwise to generalize upon the relative value of wheat and corn, if we base our conclusions merely upon the chemical composition of a patent flour on the one side, from the wholly decorticated and degerminated kernel, and that of a corn meal on the other side, in which most of the outer coating of the kernel and practically all the germ are left in the finished product. Nevertheless a comparison of the grains from the chemical standpoint is not without interest and is attempted in the following table, which includes all the cereals concerned in this bulletin. Since barley, oats and rice are always decorticated before they are eaten, the analyses of these grains entire are not given.

PERCENTAGE COMPOSITION OF BARLEY, CORN, OATS, RICE
AND WHEAT.

	Moisture.	Proteids.	Ether extract.	Crude fiber.	Carbohydrates other than crude fiber.	Ash.
	Per ct.	Per ct.	Pr ct.	Pr ct.	Per ct.	Pr ct.
Barley meal *.....	14.83	10.89	1.23	0.47	71.85	.63
Barley, pearl *.....	12.82	7.25	1.15	1.36	76.19	1.23
Corn †.....	10.75	10.00	4.25	1.75	71.75	1.50
Oats, rolled, 20 analyses ‡.....	7.70	16.70	7.30	1.30	64.90	2.10
Rice, hulled, unpolished §	12.00	8.00	2.00	1.00	76.00	1.00
Rice, hulled, polished §....	12.40	7.50	.40	.40	78.80	.50
Wheat †	10.60	12.25	1.75	2.40	71.25	1.75

* Knight. Food and Its Functions, p. 161.

† Wiley. Foods and Food Adulterants, Bul. 13, part 7, Div. Chem., U. S. Dept. Agr., p. 1190.

‡ U. S. Dept. Agr., Office of Expt. Stations, Bul. 28 (Revised), p. 57.

§ Wiley. Foods and Food Adulterants, Bul. 13, part 9, Div. Chem., pp. 1182-3.

Barley is not very extensively eaten in this country, where its principal use has been in broths and soups. In the so-called barley bread, a considerable proportion of wheat flour is mixed with the barley meal. According to Knight, such bread is usually heavy, rather indigestible, and somewhat laxative. The latter property is shared by many of the coarser cereal preparations and can probably be attributed to the mechanical condition, rather than to the chemical composition of the food. As barley is very generally employed in the manufacture of malt, its presence in the malted foods is to be expected.

Corn from its composition and cheapness deserves a more extended use. Although below wheat and hulled oats in the amount of protein which it contains, it is very rich in fat, ranking next to hulled oats in this respect. As corn meal, the form in which it is generally put upon our markets, it is regarded as less digestible than the other cereal products. This is probably in large part due to its coarse milling and the large amount of bran which it contains. The fat, which is largely confined to the germ, is a source of weakness, since it readily becomes rancid and the meal becomes musty. Hominy and samp, from which the germ has been removed, are free from this objection. An

improved method of milling corn is now coming into use by which the kernel is degerminated before being ground, the result being a product of much better keeping qualities.

Oats. The analysis of rolled oats given in the above table may be accepted as representing the composition of the kernel when deprived of its outer woody coating. In this condition their nutritive properties are in excess of those of any other of our common cereals. They contain one-third more protein than wheat and nearly four times as much fat. On the other hand they contain less starch than wheat; but since starch possesses a much lower nutritive value than protein and fat, the oats must be considered the more nutritious.

Rice is the poorest in proteids and ash of the cereals here considered and is correspondingly rich in starch. In China and the East Indies it forms the principal food of the poorer classes and failure of the rice crop would mean famine to at least one-third of the human race. In this country it is more generally cultivated than formerly, but its consumption is still largely in excess of the domestic production.

Wheat is by far the most important of our cereals, since it is the only one the proteids of which form a true gluten, the peculiar tenacity of which makes a leavened or "raised" bread possible. This property in itself must forever distinguish wheat as the bread-making cereal *par excellence*. Quite aside from this, however, the nutritive value of wheat must place it in the front rank of vegetable foods. In protein content it is excelled only by hulled oats.

COMPOSITION OF CEREAL BREAKFAST FOODS.

During the past few years a large number of cereal breakfast foods has been placed upon the market and the number is constantly increasing.

The composition of many of these goods is given in the tables which follow. In the first two tables, pages 132-3, are summarized the analyses of the brands collected three years ago and reported in Bulletin 55 of this Station. All the other analyses here given are of new samples collected during the past few months, for the most part in Bangor and Portland. The list does not profess to include all the goods then obtainable, though the omissions are probably few.

CEREAL FOODS ANALYZED IN 1899.

Laboratory number.	Name.	Manufacturer.
CORN PREPARATIONS.		
6230	Crown Flakes	Crown Cereal Company
6231	Hecker's Hominy	Hecker-Jones-Jewell Milling Co..
6232	H-O Company's New Process Hominy	The H-O Company
6233	Mazama	Mazama Health Food Company ..
UNCOOKED OAT MEALS.		
6234	A Oat Meal	American Cereal Company
6235	C Oat Meal	American Cereal Company
6245	McCann's Finest Oat Meal	John McCann
COOKED OAT PREPARATIONS.		
6242	Hecker's Oat Meal	Hecker-Jones-Jewell Milling Co..
6244	Hornby's H-O Oat Meal	The H-O Company
6236	American Cereal Company's Rolled Oats..	American Cereal Company
6237	American Cereal Company's Rolled Oats..	American Cereal Company
6338	Buckeye Rolled Oats	American Cereal Company
6239	Buckeye Rolled Oats	American Cereal Company
6241	Echo White Rolled Oats	Steward & Merriam
6243	Hecker's Rolled White Oats	Hecker-Jones-Jewell Milling Co..
6240	Peoria Rolled Oats	Steward & Merriam
6246	Quaker Rolled White Oats	American Cereal Company
6247	Tip Top Rolled Oats	Akron Cereal Company
WHEAT PREPARATIONS.		
6264	Fruen's Best Wheat Wafers	Fruen Cereal Company
6263	Fruen's Rolled Wheat	Fruen Cereal Company
6254	H-O Company's Breakfast Food	The H-O Company
6256	Old Grist Mill Rolled Wheat	Potter & Wrightington
6258	Pettijohn's Breakfast Food	American Cereal Company
6249	Cream of Wheat	Cream of Wheat Company
6251	Farinose	American Cereal Company
6252	Gould's Wheat Germ Meal	The Fould's Milling Company
6268	Germea	Sperry Flour Company
6250	Hecker's Farina	Hecker-Jones-Jewell Milling Co..
6257	Old Plymouth Breakfast Food	Old Plymouth Cereal Company ..
6259	Pillsbury's Vitos	Pillsbury-Washburn Flour Mills ..
6260	Ralston Health Club Breakfast Food	Robinson-Danforth Company
6261	Wheatena	Health Food Company
6262	Wheatlet	The Franklin Mills
6265	Shredded Whole Wheat Biscuit	The Cereal Machine Company
GLUTEN PREPARATIONS.		
6248	Cooked Gluten	Health Food Company
6253	Dr. Johnson's Glutine	Johnson's Educator Food Store ..
6269	Whole Wheat Gluten	Health Food Company
MISCELLANEOUS PREPARATIONS.		
6266	Cook's Flaked Rice	American Rice Food & Mfg Co....
6229	Glen Mills Standard Crushed Barley	Johnson's Educator Food Store ..
6267	Grape-Nuts	Postum Cereal Company
6286	Malt Breakfast Food	The Malted Cereal Company

WEIGHTS OF NUTRIENTS, AND FUEL VALUE OF ONE POUND OF
CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Price paid per package.	Weight contents of package.	Weight contents of package.	Price paid per pound.	Water.	Protein.	Fat.	Carbo. hydrates.	Ash.	Heat of combustion per pound,
	Cents.	Grams.	Lbs.	Cts.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6230	5	400	.88	5.7	.120	.081	.009	.787	.004	1740
6231	12	1329	2.93	4.1	.110	.086	.006	.794	.004	1730
6232	13 (2 for 25c.)	1324	2.92	4.5	.120	.080	.005	.792	.003	1725
6233	15	1136	2.28	6.	.107	.086	.010	.792	.005	1770
6234	In bulk			4.	.067	.175	.077	.655	.026	2025
6235	In bulk			4.	.079	.143	.074	.686	.019	1975
6245	55	2331	5.14	10.7	.051	.125	.101	.705	.019	2055
6242	13 (2 for 25c.)	828	1.83	7.1	.091	.189	.074	.627	.019	1990
6244	15	933	2.06	7.3	.093	.134	.080	.674	.019	1945
6236	In bulk			4.	.077	.139	.076	.687	.021	1975
6237	In bulk			4.	.069	.153	.076	.683	.020	1970
6238	8 lbs. for 25c. in bulk			3.1	.074	.149	.075	.682	.021	1955
6239	10	849	1.87	5.3	.080	.147	.075	.678	.020	1970
6241	10	895	1.97	5.1	.082	.146	.075	.677	.020	1965
6243	10	874	1.93	5.2	.086	.144	.081	.669	.019	1980
6240	4 cts. per lb., 7 lbs. for 25 cts., in bulk			4.	.068	.145	.078	.689	.020	1970
6246	13 (2 for 25c.)	851	1.88	6.9	.081	.148	.086	.666	.020	1955
6247	5	554	1.22	4.1	.091	.161	.079	.648	.020	1950
6264	13 (2 for 25c.)	857	1.89	6.9	.113	.093	.021	.754	.019	1750
6263	In bulk			4.	.106	.095	.020	.761	.017	1745
6254	10	578	1.27	7.9	.117	.101	.016	.748	.018	1765
6256	15	952	2.10	7.1	.112	.096	.019	.756	.016	1775
6258	13 (2 for 25c.)	841	1.85	7.0	.107	.119	.018	.739	.017	1780
6249	17	853	1.88	9.0	.106	.118	.010	.763	.004	1775
6251	15	936	2.06	7.3	.094	.141	.030	.720	.014	1840
6252	13 (2 for 25c.)	830	1.83	4.9	.111	.109	.023	.743	.014	1745
6268	15	795	1.75	8.6	.115	.129	.024	.719	.013	1795
6250	13 (2 for 25c.)	423	.93	14.0	.114	.105	.009	.767	.004	1760
6257	15	853	1.88	8.0	.123	.129	.022	.716	.011	1775
6253	13 (2 for 25c.)	951	2.10	6.2	.093	.119	.015	.766	.007	1815
6260	15	857	1.89	8.0	.121	.107	.014	.751	.008	1745
6261	25	992	2.19	11.4	.086	.150	.035	.712	.017	1885
6262	13 (2 for 25c.)	859	1.89	6.9	.116	.136	.019	.718	.011	1780
6265	13 (2 for 25c.)	398	.88	14.8	.108	.106	.015	.756	.015	1780
6248	25	416	.92	27.3	.089	.154	.035	.699	.022	1880
6253	25	410	.90	27.7	.102	.138	.009	.741	.011	1815
6269	55 (5 lbs. bag)	2274	5.01	11.	.112	.159	.046	.656	.027	1865
6266	15	387	.85	17.6	.114	.079	.001	.802	.004	1725
6229	15	908	2.00	7.5	.103	.160	.009	.779	.010	1760
6267	15	428	.94	15.9	.053	.117	.011	.797	.023	1870
6286	15	675	1.49	10.1	.080	.134	.022	.750	.014	1863

CEREAL FOODS.

Laboratory number.	Name.	Manufacturer.
CORN PREPARATIONS.		
6580	F S Granulated Hominy.....	American Cereal Company.....
6571	Hecker's Hominy	Hecker-Jones-Jewell Milling Co ..
6560	H-O Company's New Process Hominy	H-O Company... ..
6582	Nichol's Pearl Hominy	Austin, Nichols & Company....
6572	Pierce's Hominy.....	S. S. Pierce.....
6561	Ralston Hominy Grits.....	Purina Mills
6581	Nichols' Snow White Samp.....	Austin, Nichols & Company
6579	Cerealine Flakes.....	Cerealine Manufacturing Company
OAT PREPARATIONS.		
6563	Banner Rolled Oats.....	American Cereal Company
6564	Buckeye Rolled Oats ..	American Cereal Company.....
6553	Hornby's Steam Cooked Oat Meal.. ..	H-O Company.....
6566	McCann's Finest Oat Meal	Beaumont Mills, Dogheda, Ireland
6567	Mother's Crushed Oats ..	Akron Cereal Company.....
6555	Oatnuts Food.....	Liberty Pure Food Company
6589	Old Grist Mill Rolled Oats	Potter & Wrightington ..
6568	Pillsbury's Flaked Oat Food.....	Pillsbury-Washburn Flour Mills Co.
6576	Quaker Oats	American Cereal Company.....
6556	Quaker Rolled White Oats ..	American Cereal Company.
6557	Ralston Health Oats	Purina Mills.....
6578	Rob Roy Cut Oats.....	American Cereal Company.
6577	Rob Roy Rolled Oats.....	American Cereal Company.....
6716	Saxon Rolled Oats.....	American Cereal Company.....
WHEAT PREPARATIONS.		
6543	California Wheatine.	Empire Milling Company ..
6544	Cream of Wheat	Cream of Wheat Company.....
6545	Fould's Wheat Germ Meal	Fould's Milling Company
6570	Fruen's Best Wheat Flakes .	Fruen Cereal Company.....
6583	F S Parched Farinose	American Cereal Company.....
6584	Germea	Sperry Flour Company
6593	Granose Biscuit.....	Battle Creek Sanitarium Food Co..
6591	Granose Flakes	Battle Creek Sanitarium Food Co..
6585	Granula	Our Home Granula Company
6546	H-O Company's Breakfast Wheat.	H-O Company.....
6587	Old Grist Mill Rolled Wheat	Potter & Wrightington
6588	Old Grist Mill Toasted Wheat	Potter & Wrightington
6548	Pettijohn's Breakfast Food	American Cereal Company.....
6549	Pillsbury's Vitos.....	Pillsbury-Washburn Flour Mills Co.
6550	Ralston Health Breakfast Food.....	Robinson-Danforth Milling Co....
6573	Shredded Whole Wheat	National Food Company.....
6606	Sugarnuts.....	E. Merritt & Sons.. ..
6551	Wheatena.....	Health Food Company.
6552	Wheatlet	Franklin Mills Company.. ..
MALTED FOODS.		
6590	Brittle Bits	American Cereal Company.....
6569	Force.....	The Force Food Company.....
6558	Malt-Barley Breakfast Food.....	Malted Cereals Company.....
6547	Malt Breakfast Food	Malted Cereals Company.
6554	Malt-Oats Breakfast Food.....	Malted Cereals Company.....
MISCELLANEOUS PREPARATIONS.		
6562	Cook's Flaked Rice	Am. Rice Food Manufacturing Co.
6574	Cream of Cereals.....	Sam. W. Weidler
6575	Grape-Nuts.....	Postum Cereal Company.....
6559	Ralston Health Barley Food	Robinson-Danforth Milling Co....

CEREAL FOODS, WHERE PURCHASED AND COST.

Laboratory number.	Where purchased.	Price paid	Weight	Weight	Price paid
		per package.	contents of package.	contents of package.	per pound.
		Cents.	Grams.	Lbs.	Cts.
6580	W. L. Wilson & Co., Portland	15	737	1.63	9.2
6571	A. A. Gilbert, Orono	15	1366	3.01	5.0
6560	Fred T. Hall & Co., Bangor	15	1346	2.97	5.0
6582	Geo. C. Shaw & Co., Portland	22	2231	4.92	4.5
6572	James H. Snow & Co., Bangor	In bulk	-	-	5.0
6561	Fred T. Hall & Co., Bangor	10	826	1.82	5.5
6581	Geo. C. Shaw & Co., Portland	10	2115	4.66	2.1
6579	Geo. C. Shaw & Co., Portland	15	744	1.64	9.1
6563	T. F. Cassidy & Son, Bangor	25	1945	4.29	5.8
6564	A. A. Gilbert, Orono	10	894	1.97	5.1
6553	Fred T. Hall & Co., Bangor	15	876	1.93	7.8
6566	J. C. Norton & Co., Bangor	55	2295	5.06	10.9
6567	J. C. Norton & Co., Bangor	13(2 for 25)	828	1.83	7.1
6555	Fred T. Hall & Co., Bangor	12	956	2.11	5.7
6589	Geo. C. Shaw & Co., Portland	10	825	1.82	5.5
6568	Staples & Griffin, Bangor	10	860	1.90	5.3
6576	Staples & Griffin, Bangor	In bulk	-	-	3.1
6556	Fred T. Hall & Co., Bangor	12	857	1.89	6.3
6557	Fred T. Hall & Co., Bangor	10	624	1.73	5.8
6578	A. A. Gilbert, Orono	In bulk	-	-	5.0
6577	A. A. Gilbert, Orono	In bulk	-	-	5.0
6716	T. White, Bangor	25	2002	4.41	5.7
6543	Fred T. Hall & Co., Bangor	15	857	1.89	7.9
6544	Fred T. Hall & Co., Bangor	15	771	1.70	8.8
6545	Fred T. Hall & Co., Bangor	13	802	1.77	7.3
6570	J. C. Norton & Co., Bangor	13	836	1.84	7.1
6583	W. L. Wilson & Co., Portland	12	904	2.00	6.0
6584	W. L. Wilson & Co., Portland	14	761	1.68	8.3
6593	Geo. C. Shaw & Co., Portland	12½	304	.67	18.6
6591	Geo. C. Shaw & Co., Portland	15	304	.67	22.4
6585	W. L. Wilson & Co., Portland	25	417	.92	27.2
6546	Fred T. Hall & Co., Bangor	12	558	1.23	9.8
6587	W. L. Wilson & Co., Portland	13(2 for 25)	865	1.91	6.1
6588	W. L. Wilson & Co., Portland	10	512	1.13	8.8
6548	Fred T. Hall & Co., Bangor	13	842	1.85	7.0
6549	Fred T. Hall & Co., Bangor	13	927	2.04	6.4
6550	Fred T. Hall & Co., Bangor	13	821	1.81	7.2
6573	J. C. Norton & Co., Bangor	13(2 for 25)	396	.87	15.0
6806	E. Merritt & Sons, Houlton	In bulk	-	-	5.0
6551	Fred T. Hall & Co., Bangor	25	1064	2.34	10.7
6552	Fred T. Hall & Co., Bangor	13	863	1.90	6.8
6590	W. L. Wilson & Co., Portland	13	472	1.05	12.5
6569	James H. Snow & Co., Bangor	15	413	.91	16.5
6558	Fred T. Hall & Co., Bangor	13	594	1.31	10.0
6547	Fred T. Hall & Co., Bangor	13(2 for 25)	624	1.38	9.4
6554	Fred T. Hall & Co., Bangor	13(2 for 25)	617	1.36	9.6
6562	Fred T. Hall & Co., Bangor	13	324	.71	18.2
6574	T. F. Cassidy & Son, Bangor	15	864	1.90	7.9
6575	J. C. Norton & Co., Bangor	15	466	1.03	14.6
6559	Fred T. Hall & Co., Bangor	13	858	1.89	6.9

PERCENTAGE COMPOSITION OF CEREAL FOODS CALCULATED TO
WATER-FREE BASIS.

Laboratory number	Name.	Nitrogen.	Protein. (Nitrogen x 6.25.)	Fat.	Crude fiber.	N-free extract.	Ash.	Heat of combustion per gram.
CORN PREPARATIONS.								
6580	F S Granulated Hominy	1.64	10.28	.54	.32	88.62	.24	4.250
6571	Hecker's Hominy.....	1.69	10.55	.36	.42	88.46	.21	4.293
6560	H-O Co's New Process Hominy...	1.57	9.83	1.05	.36	88.29	.46	4.305
6582	Nichol's Pearl Hominy	1.50	9.36	.41	.29	89.77	.17	4.240
6572	Pierce's Hominy.	1.45	9.05	.66	.39	89.54	.36	4.332
6561	Ralston Hominy Grits.....	1.53	9.58	.93	.50	88.61	.38	4.324
6581	Nichol's Snow White Samp.	1.46	9.13	.33	.49	89.77	.28	4.233
6579	Cerealine Flakes	1.54	9.61	.60	.40	88.86	.53	4.333
OAT PREPARATIONS.								
6563	Banner Rolled Oats.....	3.12	19.50	7.38	.97	70.65	2.10	4.688
6564	Buckeye Rolled Oats	2.56	16.03	7.16	1.00	73.86	1.95	4.660
6553	Hornby's Steam Cooked Oat Meal.	2.84	17.74	7.76	.93	71.59	1.98	4.690
6566	McCann's Finest Oat Meal	2.57	16.04	8.90	.86	72.04	2.16	4.702
6567	Mother's Crushed Oats	2.77	17.30	7.79	.72	72.10	2.09	4.715
6555	Oatnuts Food.	2.75	17.20	8.35	1.02	71.38	2.05	4.703
6589	Old Grist Mill Rolled Oats	2.61	16.31	8.37	1.03	72.21	2.08	4.695
6568	Pillsbury's Flaked Oat Food.....	2.35	14.71	7.64	1.30	74.48	1.87	4.666
6576	Quaker Oats	2.78	17.38	8.57	1.06	71.18	1.81	4.722
6556	Quaker Rolled White Oats	3.07	19.18	7.61	1.05	70.00	2.16	4.731
6557	Ralston Health Oats.	3.06	19.10	7.67	1.03	70.01	2.19	4.709
6578	Rob Roy Cut Oats.....	2.54	15.90	7.51	1.03	73.43	2.13	4.696
6577	Rob Roy Rolled Oats.....	2.94	18.37	7.35	1.05	71.15	2.08	4.656
6716	Saxon Rolled Oats	3.08	19.26	7.81	1.14	69.28	2.51	4.723
WHEAT PREPARATIONS.								
6543	California Wheatine.....	1.65	10.32	2.63	1.41	83.72	1.92	4.338
6544	Cream of Wheat.	2.35	14.68	1.37	.29	83.14	.52	4.353
6545	Fould's Wheat Germ Meal	2.28	14.26	2.90	1.11	80.14	1.59	4.415
6570	Fruen's Best Wheat Flakes	1.70	10.59	2.15	1.99	83.51	1.76	4.299
6583	F S Parched Farinose.....	2.65	16.58	2.94	1.16	77.48	1.84	4.404
6584	Germea	1.60	9.98	1.36	.32	87.73	.61	4.292
6593	Granose Biscuit.....	2.14	13.39	1.71	1.13	80.88	2.89	4.297
6591	Granose Flakes.....	1.97	12.34	1.16	2.21	81.07	3.22	4.217
6585	Granula	2.41	15.09	1.28	1.95	79.92	1.76	4.368
6546	H-O Company's Breakfast Wheat	1.78	11.13	1.07	1.77	84.17	1.85	4.281
6587	Old Grist Mill Rolled Wheat	2.13	13.31	2.16	2.18	81.20	1.15	4.339
6588	Old Grist Mill Toasted Wheat	2.76	17.22	3.39	1.27	76.58	1.54	4.447
6548	Pettijohn's Breakfast Food	2.10	13.16	2.48	2.32	80.43	1.61	4.418
6549	Pillsbury's Vitos.	2.29	14.29	1.82	.69	82.21	.99	4.364
6550	Ralston Health Breakfast Food ..	2.06	12.87	1.63	1.09	83.20	1.21	4.281
6573	Shredded Whole Wheat	2.03	12.67	1.41	2.45	82.05	1.42	4.403
6606	Sugarnuts.	2.67	13.55	2.27	1.42	81.12	1.64	4.489
6551	Wheatena.....	2.62	16.36	3.26	1.06	77.70	1.62	4.431
6552	Wheatlet.....	2.38	14.89	2.45	1.18	80.17	1.31	4.378
MALTED FOODS.								
6590	Brittle Bits.....	2.42	15.11	.50	1.11	81.62	1.66	4.350
6569	Force.....	1.96	12.22	1.43	2.19	81.19	2.97	4.177
6558	Malt-Barley Breakfast Food.....	2.20	13.74	1.16	.63	83.34	1.13	4.317
6547	Malt Breakfast Food.....	2.58	16.13	2.13	.87	79.70	1.17	4.428
6554	Malt-Oats Breakfast Food.....	2.86	17.90	5.72	.99	73.50	1.89	4.614
MISCELLANEOUS PREPARATIONS.								
6562	Cook's Flaked Rice	1.55	9.67	.11	.29	89.57	.36	4.284
6574	Cream of Cereals.....	1.61	10.09	1.23	.44	87.86	.38	4.423
6575	Grape-Nuts.	2.11	13.19	1.15	1.95	81.79	1.92	4.336
6559	Ralston Health Barley Food.. ..	1.94	12.11	1.14	.72	84.87	1.16	4.306

WEIGHTS OF NUTRIENTS AND HEAT OF COMBUSTION OF ONE POUND
OF CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Name of food.	Water.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.	Heat of combustion per pound.
		Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Cal.
CORN PREPARATIONS.								
6580	F S Granulated Hominy .....	.094	.093	.005	.003	.803	.002	1747
6571	Hecker's Hominy .....	.111	.094	.003	.004	.786	.002	1732
6560	H-O Co's New Process Hominy..	.104	.088	.009	.003	.792	.004	1751
6582	Nichol's Pearl Hominy .....	.093	.085	.004	.003	.813	.002	1745
6572	Pierce's Hominy .....	.109	.081	.006	.003	.798	.003	1751
6561	Ralston Hominy Grits .....	.107	.086	.008	.004	.792	.003	1753
6581	Nichol's Snow White Samp .....	.103	.082	.003	.004	.805	.003	1733
6579	Cerealine Flakes .....	.096	.087	.005	.004	.803	.005	1777
OAT PREPARATIONS.								
6563	Banner Rolled Oats .....	.077	.180	.068	.009	.647	.019	1963
6564	Buckeye Rolled Oats .....	.096	.145	.065	.009	.668	.017	1912
6553	Hornby's Steam Cooked Oat Meal	.084	.163	.071	.008	.656	.018	1949
6566	McCann's Finest Oat Meal .....	.077	.148	.082	.008	.665	.020	1969
6567	Mother's Crushed Oats .....	.082	.159	.071	.007	.662	.019	1963
6555	Oatnuts Food .....	.084	.158	.077	.009	.653	.019	1953
6589	Old Grist Mill Rolled Oats .....	.081	.150	.077	.009	.664	.019	1958
6568	Pillsbury's Flaked Oat Food .....	.086	.135	.070	.012	.680	.017	1934
6576	Quaker Oats .....	.078	.177	.070	.010	.645	.020	1975
6556	Quaker Rolled White Oats .....	.087	.159	.078	.010	.650	.016	1960
6557	Ralston Health Oats .....	.077	.176	.071	.010	.646	.020	1971
6578	Rob Roy Cut Oats .....	.091	.167	.067	.010	.646	.019	1935
6577	Rob Roy Rolled Oats .....	.084	.146	.069	.009	.672	.020	1934
6716	Saxon Rolled Oats .....	.097	.174	.071	.010	.625	.023	1933
WHEAT PREPARATIONS.								
6543	California Wheatine .....	.091	.094	.024	.013	.761	.017	1789
6544	Cream of Wheat .....	.102	.132	.012	.003	.747	.004	1774
6545	Fould's Wheat Germ Meal .....	.102	.128	.026	.010	.720	.014	1798
6570	Fruen's Best Wheat Flakes .....	.097	.096	.019	.018	.754	.016	1760
6583	F S Parched Farinose .....	.080	.153	.027	.011	.712	.017	1837
6584	Germea .....	.098	.090	.012	.003	.791	.006	1756
6593	Granose Biscuit .....	.075	.124	.016	.010	.748	.027	1808
6591	Granose Flakes .....	.077	.114	.011	.020	.748	.030	1765
6585	Granula .....	.077	.139	.012	.018	.738	.016	1830
6546	H-O Co's Breakfast Wheat .....	.096	.101	.010	.016	.760	.017	1755
6575	Old Grist Mill Rolled Wheat .....	.088	.121	.020	.020	.740	.011	1792
6588	Old Grist Mill Toasted Wheat .....	.082	.158	.031	.012	.703	.014	1852
6548	Pettijohn's Breakfast Food .....	.097	.119	.022	.021	.726	.015	1810
6549	Pillsbury's Vitos .....	.086	.131	.017	.006	.751	.009	1810
6550	Ralston Health Breakfast Food ..	.091	.117	.015	.010	.756	.011	1765
6573	Shredded Whole Wheat .....	.073	.117	.013	.023	.761	.013	1852
6606	Sugarnuts .....	.119	.119	.020	.012	.715	.015	1794
6551	Wheatena .....	.079	.151	.030	.010	.715	.015	1851
6552	Wheatlet .....	.101	.134	.022	.011	.720	.012	1793
MALTED FOODS.								
6590	Brittle Bits .....	.069	.141	.005	.010	.760	.015	1837
6569	Force .....	.054	.116	.014	.020	.768	.028	1792
6558	Malt-Barley Breakfast Food .....	.068	.128	.011	.006	.777	.010	1826
6547	Malt Breakfast Food .....	.086	.147	.019	.008	.729	.011	1836
6554	Malt-Oats Breakfast Food .....	.064	.167	.054	.009	.688	.018	1959
MISCELLANEOUS PREPARATIONS.								
6562	Cook's Flaked Rice .....	.089	.088	.001	.003	.816	.003	1770
6574	Cream of Cereals .....	.108	.090	.011	.004	.784	.003	1806
6575	Grape-Nuts .....	.042	.126	.011	.019	.784	.018	1884
6559	Ralston Health Barley Food .....	.108	.107	.010	.006	.758	.010	1744

AMOUNTS OF NUTRIENTS FURNISHED FOR TEN CENTS IN CEREAL FOODS
AT ORDINARY PRICES.

Name of Food.	Prices per pound.	TEN CENTS WILL PAY FOR—					Heat of combustion.
		Total food materials.	Nutrients.				
			Total.	Protein.	Fats.	Carbohydrates.	
CORN PREPARATIONS.							
F S Granulated Hominy ..	Cts. 9.2	Lbs. 1.09	Lbs. .99	Lbs. .10	Lbs. .01	Lbs. .88	Cal. 1903
Hecker's Hominy.....	5.0	2.00	1.77	.19	.01	1.57	3464
H-O Company's New Process Hominy...	5.0	2.00	1.78	.18	.02	1.58	3502
Nichols' Pearl Hominy.....	4.5	2.22	2.00	.19	.01	1.80	3873
Pierce's Hominy.....	5.0	2.00	1.77	.16	.01	1.60	3502
Ralston Hominy Grits.....	5.5	1.82	1.61	.15	.02	1.44	3190
Nichols' Snow White Samp.....	2.1	4.76	4.23	.39	.01	3.84	8200
Cerealine Flakes.....	9.1	1.10	.99	.10	.01	.88	1955
OAT PREPARATIONS.							
Banner Rolled Oats.....	5.8	1.73	1.55	.31	.12	1.12	3397
Buckeye Rolled Oats	5.1	1.96	1.72	.28	.13	1.31	3747
Hornby's Steam Cooked Oat Meal.....	7.8	1.28	1.14	.21	.09	.84	2495
McCann's Finest Oat Meal.....	10.9	.92	.83	.14	.08	.61	1812
Mother's Crushed Oats.....	7.1	1.41	1.27	.22	.10	.95	2768
Oatnuts Food	5.7	1.75	1.55	.28	.13	1.14	3417
Old Grist Mill Rolled Oats	5.5	1.82	1.62	.27	.14	1.21	3564
Pillsbury's Flaked Oat Food.....	5.3	1.89	1.68	.26	.13	1.29	3656
Quaker Oats.....	3.1	3.23	2.88	.57	.23	2.08	6380
Quaker Rolled White Oats.....	6.3	1.59	1.41	.25	.13	1.03	3117
Ralston Health Oats.....	5.8	1.73	1.54	.30	.12	1.12	3409
Rob Roy Cut Oats.....	5.0	2.00	1.76	.34	.13	1.29	3871
Rob Roy Rolled Oats	5.0	2.00	1.77	.29	.14	1.34	3868
Saxon Rolled Oats.....	5.7	1.75	1.51	.30	.12	1.09	3382
WHEAT PREPARATIONS.							
California Wheatine.....	7.9	1.27	1.12	.12	.03	.97	2272
Cream of Wheat	8.8	1.14	1.01	.15	.01	.85	2023
Fould's Wheat Germ Meal.....	7.3	1.37	1.20	.17	.04	.99	2464
Fruen's Best Wheat Flaked	7.1	1.41	1.22	.13	.03	1.06	2482
F S Parched Farinose	6.0	1.67	1.49	.25	.05	1.19	3069
Germea	8.3	1.21	1.08	.11	.01	.96	2125
Granose Biscuit.....	18.6	.54	.48	.07	.01	.40	973
Granose Flakes.....	22.4	.45	.39	.05	-	.34	794
Granula	27.2	.37	.33	.05	-	.28	677
H-O Company's Breakfast Wheat.....	9.8	1.02	.89	.10	.01	.78	1790
Old Grist Mill Rolled Wheat.	6.1	1.64	1.44	.20	.03	1.21	2942
Old Grist Mill Toasted Wheat	8.8	1.14	1.02	.18	.04	.80	2111
Pettijohn's Breakfast Food.....	7.0	1.43	1.24	.17	.03	1.04	2587
Pillsbury's Vitos.....	6.4	1.56	1.40	.20	.03	1.17	2824
Ralston Health Breakfast food.....	7.2	1.39	1.23	.16	.02	1.05	2452
Shredded Whole Wheat.....	15.0	.67	.60	.08	.01	.51	1213
Sugarnuts	5.0	2.00	1.71	.24	.04	1.43	3588
Wheatena	10.7	.93	.83	.14	.03	.66	1722
Wheatlet	6.8	1.47	1.29	.20	.03	1.06	2636
MALTED FOODS.							
Brittle Bits.....	12.5	.80	.72	.11	-	.61	1469
Force	16.5	.67	.60	.08	.01	.51	1201
Malt-Barley Breakfast Food.....	10.0	1.00	.92	.13	.01	.78	1826
Malt Breakfast Food ..	9.4	1.06	.95	.16	.02	.77	1947
Malt-Oats Breakfast Food	9.6	1.04	.95	.17	.06	.72	2037
MISCELLANEOUS PREPARATION.							
Cook's Flaked Rice.....	18.2	.55	.50	.05	-	.45	974
Cream of Cereals	7.9	1.26	1.11	.11	.01	.99	2254
Grape-Nuts	14.6	.69	.64	.09	.01	.54	1300
Ralston Health Barley Food.....	6.9	1.45	1.27	.16	.01	1.10	2529

PREPARED CEREALS.

While hominy has long been in use in certain sections of the country, the general introduction of cereal breakfast foods is comparatively recent. Oat meal is a favorite dish with the Scotch and Irish and its adoption has naturally followed the immigration of these races. Formerly both preparations were coarsely ground and required prolonged cooking. The first great advance along this line was the manufacture of rolled oats, a process which consists in softening the kernel by steaming, after which it is passed between steel rollers and dried. The resulting article was found not only to keep well, but, being partially cooked, and the cell walls ruptured by the crushing process to which it was subjected, the time required in preparing it for the table was very materially shortened. Later the same process was applied to wheat, rice and corn, yielding products which are adapted not only for breakfast foods but also for the preparation of puddings and other desserts. To-day the excellence and variety of the cereal foods should excite the gratitude of the housewife, whose chief embarrassment lies in choosing among the many. It is in the hope of assisting in this choice that this bulletin is written.

All the samples collected for analysis were guaranteed fresh goods by the dealer from whom they were purchased. In spite of this precaution a number of packages when opened were found not only musty but infested with moths or the larvæ of beetles. All such samples were rejected as not fairly representing the goods. Some method should be devised whereby such stale goods should be withdrawn from the market or replaced by fresh preparations. The interests of both manufacturers and dealers would seem to demand that the consumer should have a reasonable assurance as to the quality of the goods purchased.

Of the fifty brands recently collected only twenty-one are found in the list of those collected three years ago. There seems to be a tendency on the part of the manufacturers to substitute new and attractive names for a product that has been before the public for some time.

DISCUSSION.

It is unnecessary to explain at length the terms employed in this discussion. It may be remarked that protein occupies an especially important place among the nutrients, since it can, to a certain extent, replace the fats and carbohydrates, while neither of the latter can replace the protein. Since the foods rich in protein are among the most expensive, it will be readily seen why the percentage of nitrogen present should be considered as of prime importance.

The amount of crude fiber or woody matter present gives us some clue as to the extent to which the outer covering of the grain has been removed. Thus, the whole (undecorticated) wheat kernel contains about 2.40 per cent of crude fiber, all of which remains in graham flour. The so-called entire wheat flour, of which the Franklin Mills flour is an example, is from the decorticated kernel, and contains from .80 to 1.00 per cent of crude fiber. In the manufacture of ordinary white flour, not only the outer coatings of the wheat kernel are removed, but the inner envelopes as well, leaving only from .20 to .40 per cent of crude fiber in the finished product. In the discussion which follows, the term "decorticated grain" will be used to signify the grain from which the outer coatings only have been removed.

The methods of analysis employed are those in general use. The heats of combustion were determined by the use of Atwater's bomb calorimeter.

CORN PREPARATIONS.

The 8 samples of hominy and samp examined agree as closely in composition as could be expected. The differences in fat content are probably due to varying amounts of the chit or germ left in the process of manufacture. The Cerealine Flakes differ from the other corn preparations in that they have been previously cooked and require but little additional cooking to fit them for use, while the hominy and samp require long cooking.

Of the 8 corn preparations examined, 5 show as little variation in cost as in composition, the prices ranging from $4\frac{1}{2}$ to $5\frac{1}{2}$ cents per pound. The method of preparing the Cerealine Flakes may, perhaps justify an increased price, but why F S Granulated Hominy should sell at 9.2 cents per pound and Nichol's Pearl Hominy at less than one-half that amount is not evident.

A study of the table on page 138 is recommended in this connection. It will be seen there also that in the form of Nichol's Snow White Samp at 10 cents per package, 10 cents will buy more than double the nutrients to be found at the same price in any other of these corn products.

OAT MEALS.

The analyses of 14 different brands of oat preparations are here reported. It is worthy of note that they average considerably higher in protein (16.00 per cent) than did the 14 similar preparations examined in 1899 (15.00 per cent). It is well known that the quality of the cereals vary somewhat from year to year according to the character of the growing season, and this improvement in composition is probably due to such natural causes rather than to more careful selection on the part of manufacturers or improved methods of preparation. The Banner, the Quaker and the Ralston Health Oats carry about 18 per cent of protein and the Saxon Rolled Oats over 17 per cent. The Rob Roy Cut Oats contain 16.7 per cent of protein, against 14.6 per cent for the Rob Roy Rolled Oats. Pillsbury's Flaked Oat Food was the lowest in protein (13.5 per cent) of the samples examined and was also the highest in woody fiber. The oat foods were all of good quality and bear evidence of careful preparation. The differences between them are perhaps no greater than might be expected. It is probable that the goods of different companies vary no more in composition than different samples from the same company might. For example, Hornby's Oat Meal, which in 1899 carried 13.4 per cent of protein, in 1902 carries 16.3 per cent.

For the most part the packages containing the oat preparations are free from misleading statements. The manufacturers of the Banner Oats and Saxon Oats are evidently attempting to push their sale by the "elegant piece of decorated china" enclosed in each package. It happens that the Banner Oats carry more protein than any other brand examined, while the Saxon Oats are far above the average in this respect; but this is probably accidental, as there is no reason to suppose that the American Cereal Company is making a more careful selection of oats in these goods than in the Quaker or Buckeye brands.

Hornby's H-O Oat Meal carries a guarantee that the quality of the product contained in the package is *superior* to that of any similar article. It has the composition of an average oat meal and in flavor and appearance is similar to others. It is probable, however, that the guarantee deceives but few. While the package of Hornby's Oat-Meal carried no very misleading statements, the following was taken from a package of Hornby's H-O Wheat: "Hornby's Oat-Meal is prepared by its own peculiar process under our patents so that every grain is prepared for easy digestion, making one package of more nutritive value than three packages of ordinary oat meal." While there is no doubt as to the good quality of Hornby's Oat-Meal, its chemical composition does not show it to be superior to other well made oat meals. On the other hand, its cost per pound is 25 per cent above the average and with but one exception higher than that of any other oat food here given.

The Liberty Pure Food Company claims for Oatnuts Food that "after many years experimenting we have succeeded in separating the meat of the oat from the shell, thus making Oatnuts; something heretofore found to be impossible." As Oatnuts Food has about the average amount of crude fiber, there is no evidence that the company has been more successful in "separating the meat from the shell" than other companies.

From the cost table on page 138 we find an interesting variation in the prices of these goods. One article purchased in bulk costs but 3.1 cents per pound, while the average cost is about 6.1 cents. An imported brand, put up in tin boxes, sells for 10.9 cents per pound, or nearly double the average price. This sample contained over one per cent less protein than the average oat preparation, but yielded an excessive amount of fat. It is possible that some reason exists why certain of these goods should sell for a higher price than others, but it is rarely possible to trace any relation between the cost and the actual nutritive value.

WHEAT PREPARATIONS.

Nineteen different samples of wheat preparations have been examined, 7 of which carry more than 13 per cent of protein, while 4 have from 9 to 10 per cent of protein. If one may judge from the analyses, the tendency has been to use stronger wheats than formerly in these preparations. A possible explanation of

the high protein content may be found in the fact that during the later part of the last grain growing season a severe drouth prevailed in the wheat districts, thus preventing the storage of starch in the berry and giving grain unusually high in protein.

"California Wheatine is made of first quality California white wheat, known the world over for its excellent flavor, sweetness, richness in nutritive qualities, particularly its large per cent of gluten." The California wheats do not carry large amounts of gluten as is illustrated by the low protein content (9.38 per cent) of this sample. Only one other of the 19 wheat foods examined carried as little protein as this. From the amounts of crude fiber and ash present, California Wheatine is probably prepared from more or less imperfectly decorticated wheat.

The manufacturers of Cream of Wheat continue to make the same claim as in 1899. The comments which follow, made in Bulletin 55 of this Station, are still true. "The claim that Cream of Wheat is almost pure gluten is false and should be criminal. As a food for people in health, Cream of Wheat is all right. Diabetic persons should avoid starch and sugar, and this preparation contains 75 per cent of these carbohydrates." In composition it closely resembles a good bread flour.

Fould's Wheat Germ Meal is said to be made from the glutenous portion of choice wheat. "Gluten of Wheat. Superior to oat meal." These statements are evidently intended to carry the impression that the starchy portions of the kernel are excluded, although the claim that it is "the best thing for thickening soup" must be based upon its high starch content and not upon a large amount of gluten. Its chemical composition indicates that it is prepared from decorticated wheat of average composition.

Fruen's Best Wheat Flakes, "made from the best Pacific Coast White Wheat," claims to be "the great nerve, brain and muscle food," "the indigestible matter being entirely removed." The claims are, of course, exaggerated, for Fruen's Wheat Flakes contain 1.8 per cent of woody fiber, which is indigestible. Its chemical composition indicates that it is made from a soft white wheat. From its high per cent of fiber and ash it seems doubtful if any considerable amount of the outer coatings have been removed in its preparation.

F S Parched Farinose, made by the American Cereal Company, "from Ohio's Best Amber Wheat," is among the highest

in protein of any of the samples examined. The claims, "rich in Gluten, Germ, Nitrates, Fat and Phosphates," certainly need editing. Fortunately for the users it contains no nitrates. It is evidently prepared from a hard wheat which has been decorticated. The low cost and high protein content of Farinose make it one of the most economical of the wheat preparations.

Germea "is California White Wheat, the skin peeled off, and the rest of the kernel (including germ and gluten) ground coarse." The sample was much lower in protein (9 per cent) than that examined in 1899 (12.90 per cent). The low per cent of crude fiber (.30 per cent) and ash (.55 per cent) shows that in the process of manufacture a good deal of the outer coating of the berry is removed, the product approaching common flour in composition.

Granose Biscuit and Granose Flakes, although very different in appearance, are put up by the same company and are so much alike in chemical composition that they may be considered together, the chief difference being in the amounts of fats and crude fiber which they contain. The composition of Granose Biscuit is very nearly that of a decorticated wheat, except in the high ash content, which is probably due to the presence of common salt. The Granose Flakes resemble more closely an undecorticated wheat, though somewhat deficient in fat and with an excess of ash, probably due to the addition of salt.

The fact that these goods, in spite of their high cost, seem to meet with a ready sale demonstrates the business value of judicious advertising and proves that the public is willing to pay a generous price for an attractive article. Reference to the table on page 138 shows that 10 cents will purchase only about half a pound of Granose Biscuit, having an energy-producing value of 973 calories. Granose Flakes cost 22.4 cents per pound and 10 cents pays for less than 800 calories. The same amount of money expended for flour would buy eight times as much protein and nearly seven times as much energy-producing value. We should not, however, lose sight of the fact that Granose Biscuit and Granose Flakes are ready cooked and appetizing. Whether the average consumer can afford to pay the price asked for these goods is a question that can only be answered by the individual.

Granula. "Prepared by a peculiar process original with us, embracing the use of all the constituents of the grain, which is

the best white winter wheat, grown in the famous Genesee Valley country." The manufacturers state that it is "one of the cheapest foods in use, a pound of it containing more absolute nutriment for brain and body than an equal weight of any preparation in the market." It is evidently made from a high grade hard wheat of a high protein content.

While the analyses of Granula shows it to be superior to the average wheat preparation, its price flatly contradicts the claim of cheapness. A package of these goods, containing about nine-tenths of a pound, costs 25 cents, or 27.2 cents per pound. In composition it is but slightly superior to a good flour to be had at one-tenth of the price. Reference to the table on page 138 shows that no other cereal food named in this bulletin furnishes so little nutriment for the money.

The H-O Company's Breakfast Wheat carries about 10 per cent of protein, which indicates that a soft wheat low in protein was used in its preparation. Its high fiber and ash content would indicate that it is made from undecorticated wheat.

Old Grist Mill Rolled Wheat "is prepared from the finest California White Wheat." This preparation is low in ash as compared with the crude fiber which it carries. Its percentage of protein (12.1) shows that it is made from wheat of average composition. The claim that "it is not heating to the blood" is certainly fanciful, since it has practically the same heat of combustion as the other wheat and oat products. At the price paid it compares favorably with the other foods of this class, only two of which furnish as much nutriment for the money.

Old Grist Mill Toasted Wheat. Its ash and crude fiber content would indicate that it is made from a partially decorticated wheat. The claim that it is healthful and nutritious is true of this preparation as well as of the others here reported. In its protein and fat content it ranks higher than any other of the wheat preparations examined.

Pettijohn's Breakfast Food "is made from selected Pacific coast wheat." In its preparation "the hull or covering or woody matter is entirely removed, leaving only that part of the grain containing nutritious qualities, so valuable in building up the muscles of the system, and the phosphatic matter most valuable as a nerve and brain tonic, as it is entirely free from bran." The latter statement is hardly borne out by the analysis which shows

2.1 per cent of crude fiber, practically that of the average California undecorticated wheat and higher than that of any other wheat preparation here reported, except the Shredded Whole Wheat. Its protein, fiber and ash content agree with those of undecorticated wheat.

Pillsbury's Vitos. "It is the choicest product of carefully selected northwestern hard spring wheat." This sample is higher in both ash and protein than that examined three years ago. The ash and crude fiber indicate that it is made from decorticated wheat. At 13 cents a package it is one of the cheapest of these foods.

Ralston Health Breakfast Food. The writer of the advertisement printed on the package evidently mistakes starch for gluten in explaining how one part of this food can absorb six parts of water. The amount of protein is somewhat below the average. Its crude fiber and ash indicate that it is made from decorticated wheat.

Shredded Whole Wheat "consists of the whole wheat berry, (nothing added), made light and short by a mechanical shredding and thorough cooking." Its chemical composition is that of a rather soft wheat. It is interesting to note that this most extensively advertised of wheat preparations carries no advertising statements of an exaggerated nature. While the advertisement is written with the evident intention of convincing the reader that there is no other wheat product to be compared with this, a careful inspection of the package fails to disclose any statements to which exceptions can be taken. It has the same nutritive value as the wheat from which it is made. Shredded Wheat at 13 cents a package costs 15 cents per pound and is consequently somewhat expensive, though it should not be forgotten that it is cooked and ready for the table.

Sugarnuts. "This food is made from the germ and glutinous portions of Aroostook wheat. As the germ is large and fully developed in the wheat grown in this section the food contains a large portion of the germ, giving that sweet and nutty flavor peculiar to Aroostook Wheat flour." It is sold in bulk at 5 cents a pound and is by far the cheapest of the wheat preparations named here. As it is uncooked it is not quite so quickly prepared for the table as some of the cereal foods.

Wheatena is made from "peeled wheat." "As it is deficient in starch, the dyspeptic, with whom starch is indigestible, finds

comfort from its use." As a matter of fact, the nitrogen-free extract, which includes the starch, is the same as that of any wheat products carrying an equal amount of protein (15.06 per cent). Its richness in the latter constituent is more than offset by its price, 10.7 cents per pound, which places it among the less economical foods of this class.

Wheatlet is apparently made from a good grade decorticated wheat. The claim that it is "exceptionally rich in the nitrogenous and phosphatic food elements" is true of Wheatlet only in the same sense that it is true of any other of the wheat preparations.

MALTED FOODS.

Starch, which makes up by far the greater part of the cereal grains, must be converted into soluble forms before it can be absorbed and made of use to the animal body. By the action of the saliva, and to a greater extent by the pancreatic juice, starch is changed to dextrin and maltose, which last is, at least in part, changed to dextrose or glucose, in which form it may be absorbed. Just so much of the starch as escapes this solvent action is lost as food. While raw starch is not easily digested by man, cooked starch in reasonable quantities offers no difficulty to the healthy individual. With many persons of weak digestion the starch of the food, even when properly cooked, is not well digested. Any process, therefore, which accomplishes the solvent action noted above either wholly or in part, to that extent relieves the digestive organs, and the food is, so far as the starch is concerned, "predigested."

In the germination of cereals the starch is rendered soluble by the action of a ferment known as diastase, which nature seems to have provided for that purpose. This ferment is able to convert into maltose not only the starch of the kernel in which it is formed, but a much larger amount as well. If barley be sprouted and the germination arrested before the sprout has reached any considerable length, a product known as *malt* is formed. When the malt is ground and mixed with a large amount of grain, the mass moistened and kept at a suitable temperature, the starch, not only of the malt, but of the unsprouted grain also, is converted into maltose.

The manufacturers of malt foods claim that a considerable portion of the starch of their products has thus been acted upon,

and there seems no reason to doubt the truth of the assertion. Since a long continued fermentative process would be likely to produce undesirable flavor, it is probable that a large part of the starch is still unacted on. The action can go on only when the cereal is moist and warm and must cease when the product is cooked, as ferments are destroyed by boiling. It is needless to say that the average person should not depend upon predigested foods.

Brittle Bits, "a soluble, sterilized, predigested food scientifically prepared from entire wheat and barley, producing that delicate malt flavor." "It is ready to be absorbed the moment it is put into the stomach." "One pound of lean beef gives 447 calories of heat units, while one pound of Brittle Bits gives about 1870 calories or heat units, therefore one pound of Brittle Bits is equal to four pounds of beef steak." While the latter statement is not far from the truth, it is too misleading to pass unchallenged. If fat beefsteak had been chosen for comparison it would have been found equal to Brittle Bits in the number of calories yielded. Fat yields more than twice as many calories as an equal weight of protein; yet the protein is by far the more valuable nutrient, costing more, and more essential. If Brittle Bits is compared with lean beef on the protein basis, we find that while the cereal food carries 14 per cent of protein, the meat carries about 23 per cent, or one and two-thirds times as much. It should be added that a food that "requires no effort on the part of the salivary or pancreatic glands to digest it, and makes it fit for assimilation," is not well adapted for a person in health. Nature gave us salivary and pancreatic glands and intended that they should be used.

Force. "A simple preparation of the whole of the wheat and barley malt." "With Force the work of digestion is already half done. It slips into the tissues and makes bone and muscles almost as soon as eaten." The analysis given on the package agrees quite closely with that obtained at this laboratory.

MISCELLANEOUS PREPARATIONS.

Cook's Flaked Rice, "made from Louisiana and Texas rice." It has practically the same composition as raw rice, but is cooked and quickly prepared for use. Rice is lower in protein than

wheat and oats, in its composition more nearly resembling Indian corn. The statement "Flaked Rice stands at the head of all foods as a tissue builder" is not supported by its chemical composition. The following assertions are printed upon the package:

"Flaked Rice contains 87 per cent nutriment.				
Beef	"	45	"	"
Potatoes	"	21	"	"

One pound Flaked Rice contains 21 per cent more life-giving nourishment than a pound of beef and a pound of potatoes combined."

So far as the total "nutriment" is concerned, the claim of the manufacturers might have been put more strongly. Whatever force the statement possesses lies in placing an equal valuation upon the various nutrients that are here classed together as "nutriment." Since the protein, as shown elsewhere, costs more than the other nutrients, the value of a food must depend more upon this than upon any other single constituent. The combined meat and potato contain two and one-half times the amount of protein found in the rice, a fact which more than off-sets the advantage claimed by the advertisers.

Grape-Nuts, "made by special treatment of entire wheat and barley." The statement formerly made, that "4 heaping teaspoons of Grape-Nuts are sufficient for the average meal," is now modified to read, "for the cereal part of a meal." The manufacturers still persist, however, in saying that "the system will absorb a greater amount of nourishment from 1 pound of Grape-Nuts than from 10 pounds of meat, wheat, oats or bread." The following from Bulletin 55 of this Station, pp. 103-4, shows the absurdity of this statement:

A man at moderate work needs per day about .28 pounds of protein and sufficient fats and carbohydrates in addition to make the potential energy of the day's food 3,500 calories. Four heaping teaspoonfuls of Grape-Nuts weigh about 1 ounce. The protein and energy needed for one meal (1-3 of 1 day) and that furnished by 4 heaping teaspoonfuls of Grape-Nuts are compared in the following table:

	Protein --lbs.	Fuel value --calories.
Needed for $\frac{1}{3}$ day by man at moderate work .....	.090	1,175
Furnished by four heaping teaspoonfuls (1 oz.) of Grape Nuts.....	.007	117

It would require .77 pounds of Grape Nuts ($\frac{3}{4}$ of a package) to furnish $\frac{1}{3}$ of the protein needed for one day for a man at moderate work; the energy needed would be afforded by .63 pounds.

The nutrients of beef are more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that Grape Nuts would be more completely digested than rolled oats, wheat flour or wheat bread. About 85 per cent of the protein and of fuel value of vegetable foods are digested and rendered available to the body.

In the following table there are compared the pounds of protein and fuel values of one pound of Grape Nuts with "ten pounds of meat, wheat, oats or bread."

POUNDS OF PROTEIN AND FUEL VALUE OF ONE POUND OF GRAPE NUTS COMPARED WITH 10 POUNDS OF BEEF, ROLLED WHEAT, WHEAT FLOUR, ROLLED OATS AND BREAD.

	Protein --lbs.	Fuel value --calories.
1 pound of Grape Nuts .....	.12	1,870
10 pounds round steak, including bone,	1.90	8,950
10 pounds beef rump, including bone....	1.29	14,050
10 pounds rolled wheat.....	1.01	17,650
10 pounds bread flour.....	1.31	16,450
10 pounds rolled oats.....	1.50	19,650
10 pounds white bread.....	.80	12,200

CONCLUSION.

The average percentage composition of the three chief classes of these foods is shown in the following condensed table:

Class of foods.	Number of samples.	Water.	Protein.	Fat.	Crude fiber.	N-free extract.	Ash.	Heat of combustion --calories per pound.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct	Cal.
Corn	8	10.2	8.7	.6	.3	79.9	.3	1750
Oats	14	8.4	16.0	7.2	.9	65.6	1.9	1950
Wheat	19	9.0	12.4	1.9	1.3	73.9	1.5	1800

If these figures be compared with those on page 130, a considerable variation will be noticed, due in part to a difference in the original grains and in part to the methods of manufacture. The fat of the corn kernel is mostly included in the germ which is removed in the manufacture of hominy, thus greatly reducing the fat content. In both cases, however, the three grains, corn, oats and wheat, will be found to stand in the same relation to one another, the oats carrying the most protein, fat, and ash, and yielding the greatest amount of energy per pound. Corn ranks far below oats in these respects, while wheat occupies an intermediate position. The amount of nitrogen-free extract is in inverse ratio to these other constituents.

If we study the above table in connection with the average cost per pound of these three classes of cereal foods, remembering at the same time that the protein is the most valuable of the nutrients, we are left in no doubt as to their relative economy. The average price per pound was:

Corn preparations	5.7 cents
Oat preparations	6.0 cents
Wheat preparations (omitting 4 extreme cases)	10.6 cents

In conclusion, it should be repeated that all the cereal foods examined were good articles and the average prices as a rule are not exorbitant. On the contrary, when compared with the meats and vegetables, the most of them must be classed as very economical foods. The prices are exceedingly variable and, so far as ordinary chemical analysis shows, furnish no measure of the value of the goods. On the other hand, while

their comparative digestibility has not yet been well worked out, there can be no doubt that the attempts to increase the digestibility of some of these goods by special treatment has been successful and persons of weak digestion would find it to their advantage to base their selection upon other data than that here given. Fortunately the invalids are still in the minority; and the average consumer, who will experience no difficulty with any of these foods, is not justified in paying 20 cents per pound for a cereal preparation when another, that will serve his purpose exactly as well, can be had at 5 or 6 cents.